

## REBUILDING FISHERIES IN DEVELOPING COUNTRIES<sup>1</sup>

In order to understand the challenges in rebuilding fisheries around the world, two developing country case studies are included in this Chapter. The first study is regarding cephalopods in Mauritania (primarily the octopus fishery) and hake stocks in Namibia.

These cases highlight the challenges facing rebuilding in cases where there is limited scientific data and where fisheries are an important segment of the economy.

### Cephalopods in Mauritania

This case study describes the management of the octopus fisheries in Mauritania from the 1990s until the adoption of a management plan in 2006. To date, the plan has not been implemented and the management of octopus fisheries appears to have remained the same. Based on an overview of the biological, economical and institutional context for octopus in Mauritania, this case study aims to analyze the rationale, both economic and biological, which has led to the development of the octopus management plan. Further, this case study explores the substance of the management plan and provides an analysis of both its economic and social aspects, while aiming to provide the reasons for the lack of implementation of the plan. Finally, this case study summarises key findings and identifies some lessons learned from this experience.

#### *General information*

##### *Characteristics and economics of the octopus fisheries*

Octopus (*Octopus vulgaris*) is part of the cephalopods class which also includes cuttlefish and squid. Mauritania encompasses two stocks of octopuses: a large stock in the northern part of the country which is shared with Morocco, and a smaller stock in the south which is shared with Senegal. The abundance of octopus stocks is highly variable. This is caused by important fluctuations in the environmental conditions in the region, and biological factors of this species which is characterized by a short life span and rapid growth (Inejih 2000).

The octopus fisheries in Mauritania occur largely in its Exclusive Economic Zone (EEZ). Octopuses in Mauritania are caught offshore within the northern stock from November to May. This is the largest stock in Mauritania. The southern stock which is much smaller is exploited closer to the coast from June to August.

The octopus fisheries include a large variety of operators and techniques. Most octopus fishing is conducted by the industrial fleets which are composed of demersal trawlers with ice and trawlers-freezers. Industrial fishing is conducted by both national

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and foreign vessels. In addition to the industrial vessels specialised in cephalopod fishing, others do catch octopuses as incidental catch (i.e. by-catch). These by-catches range from 2% on hake vessels to up to 15% on finfish vessels (FMEM 2004). These are not reported in data collection. The small-scale and artisanal fishers<sup>2</sup> also catch octopus, almost exclusively using pots.

The value of cephalopods catches represented in 2004 17 444 tons for USD 124.32 million (FMEM 2005) which accounts for half of the total turnover of Mauritanian fisheries. Octopus represents around 70% of this volume and 80% of the value. Average price for octopus in 2004 was USD 6 221 per ton (FMEM 2005). Cephalopods are exported to the Asian and European market almost exclusively. The Japanese market accounts for 60% of the total volume and 70% of its value. Mauritanian exports of cephalopods represented 4% of total exports in 2005 (FAO n.d.). Most of the cephalopods are exported as frozen raw, despite the effort from the government to develop processing facilities for these catches. This has not been successful and has thus failed to provide added-value to the Mauritanian octopus market.

### *Overview of the status of octopus stocks*

Monitoring and evaluation of fisheries in Mauritania is conducted every five years. Results are discussed during a meeting where all available data<sup>3</sup> is compiled into a report on the status of every commercial stock in every fishery. The report also provides evaluations and recommendations on fisheries management for the coming years; the most recent version available was published in 2006 (Failler *et al.* 2006) after the group met in 2004.

Importantly, the report has concluded that the octopus fisheries have been subject to growth overexploitation since the early 1990's. This is allegedly due to an excess of fishing on juveniles which prevents the stocks to rebuild its adult biomass. The major threat to the rebuilding of the stocks has been identified as the excess fishing effort and the overcapacity from both industrial and small-scale fleets. The evolution of the status of stocks from 1961 as compared to 2001 exploitation levels is provided in Table 1 in the annex which provides a summary of the evaluation from 1961 to 2001.

In 2004, octopus stocks were estimated to be largely overexploited: exploitation was far above the theoretical Maximum Sustainable Yield (MSY) estimated from the data collected the previous years to be around 32 000 tons whereas the total catches were estimated to be 20 000 tons. The fishing mortality was 31% in excess, compared to the 25% excess of fishing effort estimated in 1998 (Failler *et al.* 2006). This has shown an increase in overfishing on octopus stocks over the recent years.

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<sup>2</sup> In this case study, small-scale fisheries describe artisanal and coastal fisheries conducted with vessels from 6 meters to 26 meters that do not freeze their catches; industrial vessels are all vessels longer than 26 meters (FMEM 2002).

<sup>3</sup> Data on the industrial demersal fisheries originates from: database from logbooks which details catch declarations by species and fishing effort (days of fishing) by vessel and geographical zone; licenses databases which lists the industrial vessels both national and foreign which operates in Mauritania's EEZ; surveys from observers onboard vessels which report catches and details of tonnage for targeted species, by-catch and discards. Data on small-scale fisheries are based on landing surveys conducted by IMROP on the coast every six months and a database on operators and related landings classified by gears.

## *Institutional framework*

### *National institutional framework for fisheries management*

The Fisheries and Maritime Economy Department (FMEM) is the national authority responsible for the preparation, implementation, monitoring and evaluation of fisheries policies. In this capacity, the Fisheries and Maritime Economy Department is assisted by, among others, the *Institut Mauritanien de Recherches Océanographiques et des Pêches* (IMROP) which is responsible for research, data collection on fishing operations and control on sanitary measures for fish and fish products, and the *Délégation à la Surveillance des Pêches et au Contrôle en Mer*, which is in charge of control and surveillance operations and the enforcement of fisheries regulations. Also, the *Société Mauritanienne de Commercialisation des produits de la Pêche* (SMCP) is a public body established in partnership between the State and shipowners in order to organize the marketing of fish and fish products, especially frozen cephalopods, largely composed of octopuses. The SMCP is also responsible for the collection of taxes.

The current institutional and policy framework was established by the FMEM in 1998. It has three objectives: sustainable exploitation of marine resources, better integration of fisheries within the national economy and the optimization of the fishing rent. This policy has enabled the establishment of a regulatory framework through the Law n°2000/025 implementing the fisheries code (FMEM 2000) through the decree n°2002/073 (FMEM 2002).

### *Fisheries management framework*

Fishing access is regulated by the 2000 fisheries code (FMEM 2000) which defines the conditions of fishing access. Access to fishing depends on the delivery of licenses for the industrial fleet, both national and foreign. For foreign vessels, however, the delivery of licenses is possible only after the country has signed a fishing agreement with Mauritania. For example, this is the case with the EU vessels, under the current Fisheries Partnership Agreement for the period 2006-2012. Importantly, in 1998, the FMEM has frozen the delivery of licenses for national demersal trawling, which includes the octopus fisheries. For national small-scale fishers, the access is open but fishers have to pay a territorial right. This has allegedly never been enforced and small-scale fishers have not paid any fishing rights so far.

The management measures for the octopus fisheries include a set of technical measures, input control and output control. A list of all measures to octopus fisheries can be found in Table 2 of the Annex. This table also provides an assessment of the impacts of these measures and proposes some ways forward in order to improve these.

Through the fisheries code, the FMEM has implemented a set of technical measures to regulate fishing activity. These include setting a minimum size for octopus, a minimum mesh size of 70 mm and the ban on certain types of trawling gear.

Input control measures include a ‘biological stop’ of fishing implemented by the FMEM in 1995 between the first of August and the thirty-first of September. Practically, this measure partially managed to reduce the fishing activity on octopus during its reproduction period but it failed to reduce significantly the excess fishing effort and the increasing overcapacity in the octopus fishery. Input control also includes spatial zoning in order to avoid conflicts between industrial and small-scale fisheries and to prevent demersal trawling in highly productive shallow waters. This has shown positive results on

the limitation of conflicts between industrial and small-scale fishers for access to fishing grounds.

The output control measure consists of limiting the octopus by-catch from other vessels targeting other species. Apparently, a considerable number of fishing vessels operating under shrimp or hake fishing license do target octopus. This practice is called “fake fishing” in Mauritania. Fishing of octopus are then neither declared nor accounted for. The economic rationale underlying such practices is obvious: cephalopods fishing licenses are much more expensive and difficult to obtain than shrimp fishing licences for example. As shrimp fishing uses almost the same gear as octopus fishing, it is easy to target this species. Octopus catch limits have thus been set to 15% of total catches for shrimp and hake trawlers. Although binding, this measure has been difficult to enforce, as this type of control on foreign trawler-freezers requires observers onboard vessels.

### *Transboundary perspective: regional cooperation and fisheries agreements*

Mauritania is a party to various transnational fishery bodies. The regional fishery body in force in Mauritania is the Fisheries Committee for Eastern Central Atlantic (CECAF). Importantly, the CECAF is an advisory body integrated with the FAO and is responsible for the compilation of Mauritania’s fish stock assessments and the provision of advice on the management of these stocks. Mauritania is also party to the Regional Convention on Fisheries Cooperation Among African States Bordering Atlantic (ATLAFCO). At a regional level, Mauritania is a party to the Sub-Regional Commission for Fisheries (SRCF) which was established in order to help manage resources in seven states bordering the Atlantic, from Mauritania to Sierra Leone in the south. The main objective of the SRCF is to harmonize the long-term policies of its Member States in the preservation, conservation and exploitation of fisheries resources for the benefit of their respective populations. In practice, this type of regional cooperation is not carried out although most stocks are straddling across countries and small-scale fishers do migrate in significant numbers within the region. The superimposition of regional bodies hence creates some confusion on roles and responsibilities and regarding which body would be authorized to undertake actions to enhance regional cooperation provide a regulatory framework, support the development of research or management, etc.

Over the last decades, fisheries in Mauritania have been characterized by a large proportion of foreign vessels fishing through the signing of fishing agreements. From 1987, the principal signatory of fishing agreements with Mauritania is the European Union (EU), followed by Eastern European countries. For example, the EU has concluded a recent Fisheries Partnership Agreement (FPA) with Mauritania that covers the period 2006-2012, with a financial contribution fixed at 86 million EUR for the first year, out of which 11 million EUR is dedicated to the support of the fisheries policy of Mauritania (European Community 2008). This fisheries agreement is the most important fisheries agreement for the EC, both in financial and economic terms. Under this agreement, 32 European vessels targeting cephalopods are allowed to fish in the Mauritanian EEZ.

### *Fisheries rebuilding plan framework*

#### *Development of the octopus fisheries management plan*

Following the results of the 2004 IMROP evaluation meeting, it appeared urgent for the FMEM to reduce the fishing effort on the octopus fisheries. This was motivated by a view to maximise the rent gained from octopus fisheries. This has forced the management

authority to undertake the development of a management plan in order to specifically and efficiently address the octopus stocks and related fisheries.

Hence, in 2004, in order to develop the management plan, the FMEM brought together international experts, members of the various fishery bodies in Mauritania (e.g. IMROP, SMCP, etc.) and members of the private sector in order to create an advisory group. This group aimed to assess the strengths and weaknesses of the current management regime for the octopus fisheries (research and evaluation, control and surveillance, effort limitation, technical measures, information system, etc.). Based on this assessment, coupled with the description of several other international experiences, the group worked on the feasibility of various management scenarios (2004).

As a result of this process, a final proposal was submitted to the government and adopted in 2006 (FMEM 2006a; FMEM 2006b). The plan implementation is based on a two-pronged approach. The first stage focuses on the strengthening of the current regime. This may be conducted over several years, until the enabling conditions are met in order to implement the targeted management tools and measures scheduled in the plan (this part mostly deals with the implementation of Individual Transferable Quotas). Along with targets and the measures planned, a major priority of the management plan is a sound performance management structure and the monitoring of the plan's implementation process. For this purpose, the plan anticipates that a commission should be created in order to assess implementation and monitor the performance of the plan.

#### *Management responses: limiting the fishing effort*

The plan follows the objectives to limit fishing effort through the improvement of scientific advice, setting sound fishing limits and targets for the octopus fisheries and the strengthening of existing management measures.

First, a major challenge lies in abandoning scientific advice which is based on a model using data from previous years in order to develop a forecasting model. This should allow for more reactivity and improved management. Data on stocks and fisheries are available only every five years. This type of monitoring has been judged far too inadequate to offer sound management of the octopus resource which is highly inter and intra-annually variable and as recruitment is not easily predicted. In order to improve scientific advice, research on the biology and dynamics of the octopus stocks needs to be undertaken as a first step. Once this has been accomplished, experts from the working group on the plan are confident that it could be possible in a few years to release annual scientific advice and set allowable catches for the season after obtaining the agreement of the octopus commission. It is easy to monitor catches of small-scale fisheries regularly since landings are day-to-day and easily traceable. For industrial fleets, which land every two or three months, monitoring is much more difficult. Also, the majority of this fleet does not land their harvest in Mauritania, so catches are even more difficult to monitor. The plan then suggests the implementation of a Vessel Monitoring System (VMS) for all vessels, a measure which is already in the process of being implemented.

The question remains regarding the fishing target to be set. The plan details the process by which annual scientific advice can be released, ultimately leading to the setting of a catch limit. But the plan does not provide guidelines for establishing the fishing target. The most likely target to be used is the MSY. However, experts also proposed that eventually the Maximum Economic Yield (MEY) should be put into force, since this target is more conservative and would contribute more to increasing the rent gained from the fisheries.

Along with the control of effort, the plan proposes to further strengthen the existing technical measures and input controls. Regarding the issue of ‘fake fishing’, the plan has proposed that a shrimp management plan could be established in order to complement the efforts of the octopus fisheries management, by preventing shrimp trawlers from targeting octopus.

### *Management responses: addressing small-scale fisheries open access*

The most urgent measure to undertake with regards to small-scale fisheries is the control of capacity. Taking stocks listed on the FAO International Plan of Action for the Management of Fishing Capacity (FAO 1999), the plan has proposed a programme to reduce capacity of these fisheries as follows: the registration of pirogues<sup>4</sup>; the delivery of octopus licenses for small-scale fishing of octopus; a temporary freeze on the number of pirogues targeting octopus; the implementation of transferable licenses; the evaluation of the required number of pirogues in order to exploit the octopus resources sustainably; the reduction in number of pirogues to the appropriate amount; and lastly, the monitoring of the total number of pirogues in order to refrain capacity from increasing again. These appear to be consistent with the objectives of the plan. However, few details are given on how to achieve this challenging programme in light of the possible perturbing social tradeoffs that could result, which are not addressed in the plan.

### *Management responses: control and surveillance*

The plan deals with the question of monitoring and surveillance of both the trawling fisheries and the small scale fisheries. For industrial trawlers, they will have to declare all catches every 24 hours, in addition to the installation of VMS on all vessels. Trawlers will also have to provide the authorities with logbooks on a monthly basis.

The plan does not address precisely the control and surveillance measures on small-scale fisheries. The plan recommends first conducting pilot projects on monitoring in order to assess the feasibility for such processes. Details about how the control should be conducted are rather unclear, and it is planned that this will be developed later.

### *Economic aspects*

#### *The rent gained from the octopus resource*

In 2006, the fisheries sector contributed up to 12% to the national GDP (FAO, n.d.). In 2004, 90% of the fisheries production value originated from the industrial fleets, which produced in 2003 163 610 tons of fish (FAO n.d.). Cephalopod industrial fisheries were the most important with 185 active industrial vessels in 2003, 125 national vessels and 55 from the European Union. Average exports of cephalopods for the period 1999-2001 reached 33 000 tons for a total value of USD 115 million. Octopus represented 70% of this volume and 80% of the value (USD 91 million). Octopus is therefore very important to the national revenues and this represents a rent that is deemed crucial to maintain.

In terms of contribution of the fisheries sector to the public receipts, fisheries agreements are a great asset for the national revenue. Hence, the contribution from fisheries increased from 21-26% in the 1990's to 30% in the next decade (FMEM n.d.), and this is largely because of the contribution of the fisheries agreements with the

<sup>4</sup>. A pirogue is a small, flat-bottomed boat of a design associated particularly with West African small-scale fishers.

European Union. As a result of the overexploitation of fish stocks, the rent gained from fishing has been decreasing, and the direct financial compensation paid from international fisheries agreements has become increasingly important to the national economy, leading to an increased dependence upon fisheries agreements as a source of revenue. This is hazardous to the national economy, as fisheries agreements are finite and these may not last for long as the resource is diminishing.

### *Economic aspects of the octopus management plan*

Clearly, the first objective of the management plan is to maximise the rent provided by octopus fisheries. The plan insists on the fact that octopus resources are not key to national food security and that the FMEM should seek to maximise the rent. In order to illustrate this point, experts have estimated that exploitation at the MSY level, with the same number of vessels, would result in USD 26 million. In addition, adjusting the number of vessels to this MSY exploitation level would double this value and bring the rent to USD 54 million (Cunningham 2006). Consequently, it is more profitable to adjust the capacity towards the MSY exploitation level. However, the plan does not provide for a scheme to achieve this goal.

Going even further, the experts propose the use of the MEY<sup>5</sup> instead of the MSY previously used, in order to manage the fisheries. This would have the effect of favouring maximisation of the rent rather than the full exploitation of the resource, of which the latter is not a priority for the managing authorities. However, this target seems far from being feasible in reality and according to the increasing number of people depending on octopus fisheries for their revenue, this measure could appear to be not socially acceptable. In that sense, the plan does not propose any accompanying measures (e.g. decommissioning schemes) in order to smooth the path for fishing effort adjustment.

In an attempt to further the knowledge on the impact of industrial fishing, the FMEM has commissioned in 2005 an in-depth study on the adjustment of the national industrial fleet targeting octopus and the opportunities to transfer this capacity to other segments of the sector (FMEM 2005). This study entails an assessment of the profitability of the sector, the estimation of the added value to the public sector and to the private sector from various ship-owners (Chinese, Mauritians, joint ventures), and the identification of three major constraints to the flexibility of the national industrial fleet: the dilapidation and high debt ratio of the fleet; the lack of funding for modernization; and the lack of training opportunities and adapted landing sites. Despite these barriers to effective adjustment, the study proposes three options for adjustment which includes the following:

- A choice between European and national fleets;
- The withdrawal of licences for underutilized vessels and the overall improvement of licenses management; and
- The redeployment of the national fleet to other segments.

Despite this, no major scheme has been undertaken since 2005 in order to implement the proposal. This appears as a good illustration of the effort invested in strategic thinking for achieving a sustainable fisheries sector in Mauritania while implementation is still pending.

<sup>5</sup> The MEY is the highest theoretical equilibrium yield that can be continuously taken (on average) from a stock under existing (average) environmental conditions without affecting significantly the reproduction process.

Also, the plan proposes the introduction of Individual Transferable Quotas (ITQs) for octopus fisheries management. International experts have stated that an ITQ system could be feasible in Mauritania if the government was willing to implement it. According to the experts, an ITQ system provides for:

- Improved cooperation between researchers and fishers, and would acknowledge the fact that fishers have a real interest in conserving their resources and would set quotas accordingly;
- More flexibility through transferability, with a direct positive effect on reducing discards; and,
- The creation of social pressure to respect the rules: if a fisher does not respect the rules, it is the whole fishing community that suffers.

Positive examples from developed countries have been made available by the experts. It is however important to note that such a system requires several arrangements to actually deliver an efficient participatory process. Moreover, an ITQ system requires an efficient and updated monitoring system in order to be able to effective. Thus, such system is an option, but the current state of the management does not permit for such system to be implemented yet.

### *Financing the plan*

Over the years, the contribution of the fisheries sector to the government has decreased substantially. This is partially due to a change away from a tax on exports collected by the SMCP towards a fishing access based on licences: amounts collected from the tax payments were higher than fishing rights collected after 1995 (FMEM, 2006b). The sector has therefore observed a reduction of revenues from taxes. As a result, there is a need to rethink the tax system in order to be able finance part of the plan through this system.

Accordingly, the tax system has been placed as a central issue to be addressed within the plan. The group preparing the plan estimated its total cost to be around EUR 7 million over three years, with costs for infrastructures accounting for more than 40% (FMEM 2004). The question of financing the plan has emerged as a central concern in terms of achieving its goals. While it was agreed that the infrastructures costs should be assumed by the government, the plan failed to address how the tax system could provide for the remaining 60% of the funds required. Therefore, there is a risk that a lack of funds would eventually grow the plan implementation weaker.

### *Social aspects*

#### *Social aspects of the octopus fisheries sector*

The fisheries sector in Mauritania represented in 2004 almost 37 000 people working in harvesting and post-harvesting activities (FAO n.d.). The population working in the fisheries is increasingly mobile and adaptive (Failler *et al.* 2006). As an illustration, the report recorded the impact of the biological pauses on fishing and concluded that these had minor impacts on the labour force: fishers affected by the cessation of activity increasingly turned their efforts to other resources instead of stopping work for the two month period. As a result, their annual revenues were not reduced greatly and their fishing activity was only slightly affected.

Further, the management of the fisheries sector in Mauritania is based on a collaborative approach. Participation of all stakeholders is promoted and made possible through the socio-professional organization, the *Fédération Nationale de Pêche* (FNP), which gathers together all groups - shipowners, processors, small-scale fishers, fishmongers, etc. It is a group that speaks with one-voice which takes part in the whole management process, and benefits from a lot of credibility with the national authorities. Sub-groups within the FNP are equally represented within the *Conseil Consultatif National pour l'Aménagement et le Développement des Pêcheries*, a stakeholders advisory council for the management of fisheries, created by article 12 of the Law establishing the Code for Fisheries (FMEM 2000).

### *Social aspects of the plan*

As described earlier, the plan design has been largely based on collaboration between members of the government, the private sector, as well as international experts. Therefore, the design has left room for discussion among stakeholders, as well as the inclusion of best practices brought by international experts.

Despite this participative approach, it is surprising to see that the final plan does not provide for social measures to help fishers adjust to sustainable fishing. Social tradeoffs have not been evaluated in the plan despite the fact that fishers have taken part in the process. The fact that the benefits from the rent maximisation are intended to be shared among all stakeholders is expected to smooth such an adjustment; nevertheless, it is still unclear how this can be practically achieved.

The implementation of the plan has also benefited from a willingness to promote a collaborative approach. Hence, a committee was created in 2007 by decree (FMEM 2007), entitled the *Commission d'appui au suivi et à l'évaluation de la mise en œuvre du plan d'aménagement du poulpe* (CASE-PAP). The CASE-PAP is composed of representatives from all institutions and organizations related to the octopus fisheries sector. Its role is to provide the review of the implementation process and support the full implementation of the plan through negotiations between all stakeholders. For this purpose, the CAE-PAP has adopted an action plan in order to follow up with the octopus management plan, and the most recent document available on these CASE-PAP meetings is dated May 2007 (CASE-PAP 2007). It has to be confirmed whether or not the process is still on-going.

### *Implementation issues and lessons learned*

#### *Key findings about the management of octopus fisheries in Mauritania*

The case study presented in this paper provides a unique example of the context for rebuilding fish stocks in a West African country whose economy is highly dependent on fisheries. In the case of octopus which can somewhat be considered as a “cash crop” in fisheries that do not contribute to food security, the government has put an emphasis on the maximisation of the rent gained from fisheries. This approach is based on economic objectives, and places social tradeoffs as secondary. However, this approach should be studied more in detail for other fisheries which do contribute significantly to food security as well as to the provision of sustainable livelihoods in coastal communities (e.g. small pelagics). In this case study, the objectives of fisheries rebuilding identified at the World Summit on Sustainable Development in Johannesburg is not considered within fisheries

management policy. In Mauritania, rebuilding is only considered in terms of the maximisation of the rent.

This case has identified some good practices in the process of implementing rebuilding plans, and has also highlighted weaknesses. Good practices in this case revolve around the collaborative process that has led to a consensus in the development of the management plan. Also, based on the objective of rent maximisation, an associated objective was to redistribute the benefits to all users, and not only to the government. In practical terms, this still remains to be done.

Major weaknesses revolve around the lengthy process taken by the FMEM to undertake practical measures at a time when the stocks are depleted and the situation is worsening. Also the plan lacks regional cooperation in managing a resource that is shared between countries. In addition, the approach is species specific and lacks an ecosystem-based approach to management that would more appropriately take into account the related stocks.

Major issues highlighted in this study on the management of octopus fisheries include:

- Outdated data and the inability to meet targets on the exploitation of these stocks: Fisheries management in Mauritania is based on historical stock assessments, as opposed to forward looking assessments, and therefore no targets are set; further, it is these historical assessments that provide for management direction which has led to the ever-increasing excess fishing effort over the past decade;
- The inability to take stock of knowledge and strategic thinking that has been conducted: managers do know the way forward in order to strengthen management but comparatively this is not turned into practice;
- The failure to consider the social acceptability of management measures: management is essentially based on increasing the rent but the actual redistribution of benefits is left unclear;
- There is an increasing financial dependence upon fisheries agreements with the European Union while the resource is being increasingly depleted, effectively lowering the potential rent; and,
- There is a succession of management measures implemented without any coordination among them, coupled with the lack of set objectives for these measures.

Regarding the design and adoption of the management plan, key issues identified are:

- A collaborative approach to the design of the plan, based on experiences from abroad (only from developed countries) and identified good practices in implementing the management plan;
- Failure of the plan to practically and immediately address the key challenges: the process for plan development has been very informative on the status of the fisheries and on the room for improvement (capacity adjustment, management measures, rent maximisation, etc.) but it fails to take stock of this and to aim to apply the proposed measures;
- The lack of regional cooperation and coordination in order to design a transnational management plan on resources that are shared; while it is important to translate

rebuilding plans into national law, it is also crucial when threatened stocks are shared among countries to coordinate actions undertaken and cooperate on the implementation of such plans;

- The use of monospecific MSY targets and the overall lack of an ecosystem-based approach to management and a failure to utilize applied economic instruments that integrates ecological and societal concerns;
- A long process: the project of a plan on octopus fisheries was first raised in 2000 and translated into law in 2006;
- The plan does not address social concerns ; while equitable redistribution is featured, it is still unclear how this can be effectively done; and,
- Weak potential for implementation: as the plan has been under development for the last two years, it is unclear as to whether this is due to a lack of political willingness, lack of funds, or lack of agreement between stakeholders.

### *Key findings about the case study*

Drawing from this example, it is possible to identify some key issues on the rebuilding of fish stocks. These are detailed below and arranged around three key topics: the threats to the rebuilding of fish stocks; the process and content of the rebuilding plan; the implementation of the plan; and next steps.

With regards to the identification of threats to the rebuilding of fish stocks, key issues include the following:

- Lack of current data which prevents the provision of sound scientific advice and proper monitoring; proficient data collection and updated scientific advice is key to the implementation of rebuilding programmes in order to monitor, assess performance of the programme, and be reactive while the programme is being implemented;
- Lack of targets to manage fisheries; it is key that rebuilding programs be supported by forecasting models and the setting of targets on an annual basis; and,
- Lack of up-to-date knowledge about major issues; this has been the case with open access small-scale fisheries which have seen their effort levels increase dramatically.

Key points with regards to the process for designing a rebuilding plan have been highlighted through this case study. They include the following:

- The need for consultations and collaboration during the design process; the plan can then draw upon past experiences and identified good practices that are feasible. The collaborative approach allows for the drafting of a negotiated plan that takes into account the perspectives from all stakeholders;
- The need for precise, clearly articulated and realistic sources of funding for rebuilding plans;

- The need for coherence of the plan with the institutional, economical and social context for the fisheries sector; and,
- The need for precision of the plan; as much as possible, approaches for implementation should be integrated and the actions to be undertaken more detailed; generally, including several stages of implementation tends to weaken the plan and prevent it from meeting its goals.

Regarding the implementation of the plan and next steps, key issues include the following:

- The need for increased political willingness after the design of the plan in order to translate the proposals into actions;
- The integration of the plan within the general fisheries management context;
- Work on social acceptance of the plan in order to facilitate its rapid implementation; and,
- Funding must be ensured for several years until the resilience of measures undertaken is secured.

## Annex A.

Table A.1. Data on octopus fisheries Indicators based on Fox model for year 2001

	1961	1971	1981	Total
Maximum Sustainable Yield (tons)	37 908	34 155	30 936	32 000 to 36 000
Fish effort compared to 2001 (%)	59%	49%	29%	45 to 60%
Catch loss (%)	42%	25%	6%	15 to 40%
Depletion or Biomass loss (ratio of the biomass in a given year to that in a virgin state)	81%	86%	76%	80 to 91%

Source: FMEM 2006.

Table A.2. Evaluation of management measures

Measures	Nature	Fleet targeted	Details	Assessed impact	Further proposals
Minimum size	technical	Small scale fleet, foreign industrial fleet, industrial national fleet	Minimum of 500 grams when eviscerated	Relevant measures but hard to enforce on foreigners trawler-freezers	-Specific evaluation required for the enforcement of measures; - observers onboard industrial vessels to enforce the regulations; -further efforts are required on control and surveillance of the fleets;
Mesh sizes	technical	Small scale fleet, foreign industrial fleet, industrial national fleet	70 mm minimum	Relevant measures but hard to enforce on foreigners trawler-freezers	
Ban on certain types of trawling	technical	foreign industrial fleet, industrial national fleet		Relevant measures but hard to enforce on foreigners trawler-freezers	
zoning	Input (effort) control	Small scale fleet, foreign industrial fleet, industrial national fleet	No trawling on depths above 20 meters; exclusive zone for small-scale fisheries	Much relevant to avoid fleets conflicts	
Biological stop	Input (effort) control	Small scale fleet fishing with pots, foreign industrial fleet, industrial national fleet	Two months (sept-oct)	-Low impact on octopuses catches; -positive impact on reproduction rate; -positive on related species from ecosystem	
By-catch limits	Output (catch) control	Industrial shrimp and hake trawlers	octopus catch to be less than 15% of total catches	Relevant measures but hard to enforce on foreigners trawler-freezers	-Selective trawls for shrimpers; -further control on zoning for hake trawlers

Source: Adapted from Failler *et al.* 2006.

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